



85025AEK  
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Lelia Cosimbescu, et al

GREEN ORGANIC LIGHT-  
EMITTING DIODES

Serial No. 10/662,272

Filed 15 September 2003

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA. 22313-1450

Sir::

Group Art Unit: 1774

Examiner: Dawn L. Garrett

I hereby certify that this correspondence is being deposited today with the  
United States Postal Service as first class mail in an envelope addressed to  
Commissioner For Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

*Deidra L. Mack*  
Deidra L. Mack

*August 2, 2005*  
Date

DECLARATION UNDER RULE 131

The undersigned, Lelia Cosimbescu, declares that:

She is a co-inventor in the present application.

She is now and has been, since the date of the present invention, an  
employee of the Eastman Kodak Company.

In accordance with Kodak's established procedure for preparing test  
samples, she submitted to Kodak research a request to prepare and test samples  
bearing the run number LC020614-1(A-F) prior to December 19, 2002 (date has  
been redacted) (See Item 1 of the attached Exhibit A).

The date of the submission of Exhibit A is accurate and the typed  
information was present on the date of submission and contains comparisons A,  
B, and F, and inventive samples C-E; hand-written notes were entered after  
receiving the test results.

The following shorthand indications are decoded as follows:

DPQA or Dopant 1: diphenylquinacridone = Inv-1a

t-BuDPN or Dopant 2: di t-butylphenyl naphthacene = Inv-1b

Alq or "Emitter host": tris(8-quinolinolato)aluminum(III)

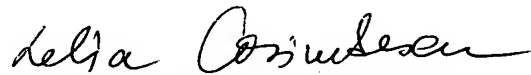
Thus Exhibit A shows the submission of samples containing a light emitting layer containing a host (Alq), an emitting first dopant (DPQA); and a stabilizing second dopant (tBuDPN).

Exhibit B includes the luminance test results for the samples of Exhibit A, LC020614 (B-F), and is dated prior to December 19, 2002 (date has been redacted at Item 2).

Exhibit C includes graphic stability test results (Operational Fade) represented by the luminance loss on the left axis and voltage increase on the right axis. The graph is based on numerical results as exemplified by Exhibit D for sample LC020614-1B and C dated prior to December 19, 2002 (date has been redacted at Item 3.)

The foregoing demonstrates that an electroluminescent device containing a host (Alq), a light-emitting first dopant (DPQA) and a stabilizing second dopant (tBuDPN), was reduced to practice by the present inventors prior to December 19, 2002.

The undersigned declares further that all statements made herein of the undersigned's own knowledge are true and all statements made on information and belief are believed to be true. These statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



Lelia Cosimbescu

Date: Aug 2<sup>nd</sup>, 2005

2 Green Dopant

LC020614-1

ITEM 1

Cosimbescu

BB9615-196a

DPQA+stabilizer

DPQA (350)/stab(275)t-BuDPN

stab. eff.  
great

Can I have sple bac  
please 8 196a  
RT fade.

Cell label (A-F)	A	B	C	D	E	F
Substrate	Polytronics glass					
Anode: ITO						
Pretreatment:	CFx	CFx	CFx	CFx	CFx	CFx
HTL material	NRB	P4UGS2	TF 78.6			
Thickness (A)	750	750	750	750	750	750
Rate (A/s)	4	4	4	4	4	4
Emitter host	Alq	P15UGS2	TF 77.7			
Thickness (A)	375	375	375	375	375	375
Rate (A/s)	3.78	3.78	3.75	3.75	3.78	3.78
Rate high/low						
EMI dopant: RATIO 13 DPQA	DPQA	DPQA	DPQA	DPQA	DPQA	DPQA
Dopant Volume %	none	0.60%	0.60%	0.60%	0.60%	0.00%
Thickness (A)	0	2.25	2.25	2.25	2.25	0
Rate (A/s)	0	2.38	2.38	2.46	2.23	0
Dopant 2 RATIO 22 t-BuDPN	t-BuDPN	t-BuDPN	t-BuDPN	t-BuDPN	t-BuDPN	t-BuDPN
Thickness (A)	0.0%	0.0%	1.815	0.5% 4.125	3.75 1.0% 82.5	18.75 0.5% 4.125
Rate (A/s)	0	0.02	1.82	1.88	2.21	18.27
EMI	Alq	P5UGS2	TF 77.7			
Thickness (A)	375	375	375	375	375	375
Rate (A/s)	3.78					
Cathode: Mg/Ag						
Mg thickness (A)	2000	2000	2000	2000	2000	2000
Mg rate (A)	10	10	10	10	10	10
Ag thickness (A)	200	200	200	200	200	200
Ag rate (A)	1	1	1	1	1	1
Device data @ 20 mA	A	B	C	D	E	F
Voltage						
W/A						
Cd/A						
CIEx						
CIEy						
L (cd/m^2)						
peak wavelength						
Thickness (A)						
PEDOT thickness						
Turnon field						
% drop @ 100 h						
T <sub>1/2</sub> (Hour)						

t-BuDPN  
Temps

X X 216°C 225.4°C 247.9°C 248.7°C

BATCH  
183a  
282°C

Exhibit B

Std Cell 4Qu.  
Z:\Utilities\LabVIEW Tests\RDIO\Std Cell 4Quad.vi  
Last modified on 3/12/02 at 9:31 AM  
Printed on: 3/12/02 at 4:16 PM

# Standard Cell 4-Quad

>> Enter Panel ID >>  
18 Characters Max

LC020614-1-F

Cell Size (cm^2)  
100.0E-3

Test Date 6/14/02  
Test Start Time 4:14 PM  
Run Time (sec) 108

## Quadrant "1"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1025	2.00	2.04
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.326	0.630	520.0	64.0
Current {mA}	Voltage {VDC}	Efficiency {W/A}	
2.000	7.91	0.03	
Yield {cd/A}	Efficacy {lm/W}		
5.13	513		

## Quadrant "2"

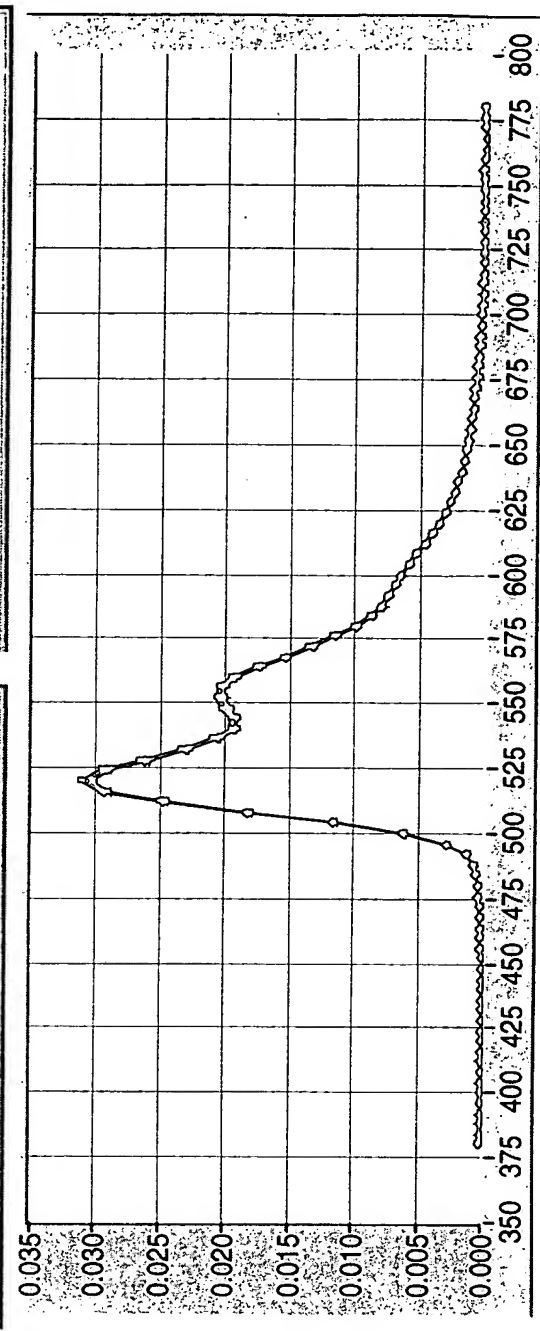
Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1052	2.05	2.08
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.326	0.630	520.0	64.0
Current {mA}	Voltage {VDC}	Efficiency {W/A}	
2.000	7.96	0.03	
Yield {cd/A}	Efficacy {lm/W}		
5.26	512		

## Quadrant "3"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1019	1.99	2.04
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.326	0.630	520.0	64.0
Current {mA}	Voltage {VDC}	Efficiency {W/A}	
2.000	7.84	0.03	
Yield {cd/A}	Efficacy {lm/W}		
5.10	513		

## Quadrant "4"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1029	2.00	2.08
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.325	0.630	520.0	60.0
Current {mA}	Voltage {VDC}	Efficiency {W/A}	
2.000	7.79	0.03	
Yield {cd/A}	Efficacy {lm/W}		
5.15	513		



Data File Pathname

Z:\data\rdio data\lum4nc\LC020614-1-F LUM4NC 6930490.DAT

Write Data File? Serial Port {0} K2400 GPIB Address Compliance Level

No ☒ Yes ☐

24

25

Exhibit B

# Standard Cell 4-Quad

>> Enter Panel ID >>  
 18 Characters Max

LC020614-1-E

Test Date 6/14/02

Test Start Time 4:12 PM

Run Time (sec) 130

Cell Size (cm^2)  
 100.0E-3

## Quadrant "1"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	950	1.81	1.76
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.326	0.633	524.0	56.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.48		0.03
Yield {cd/A}	Efficacy {lm/W}		
4.75	525		

## Quadrant "2"

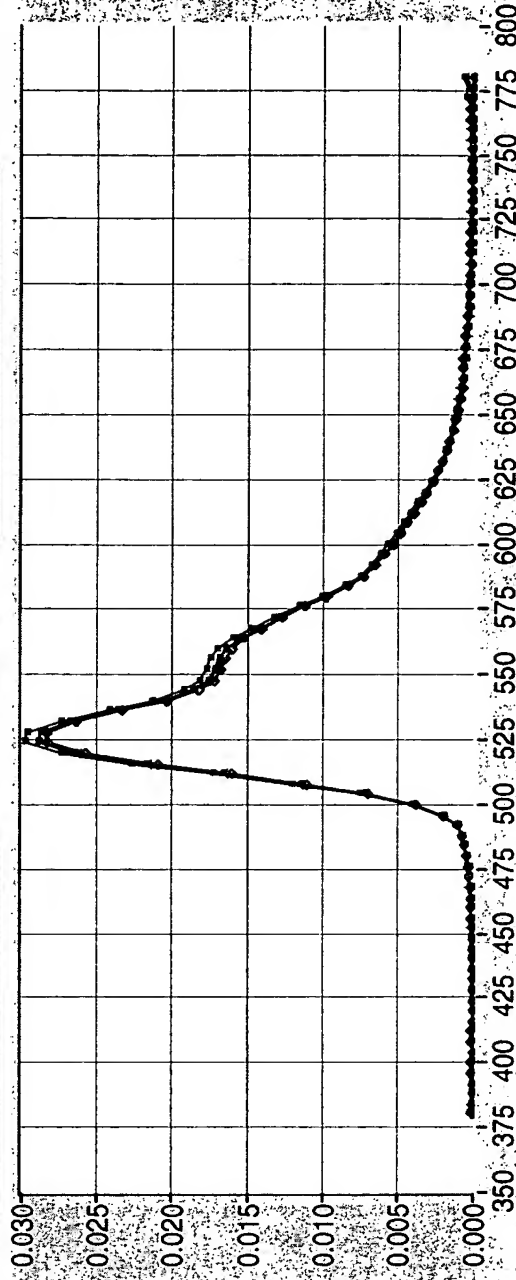
Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	984	1.88	1.81
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.326	0.633	524.0	56.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.56		0.03
Yield {cd/A}	Efficacy {lm/W}		
4.92	523		

## Quadrant "3"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	939	1.79	1.74
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.327	0.633	524.0	56.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.50		0.03
Yield {cd/A}	Efficacy {lm/W}		
4.70	525		

## Quadrant "4"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	932	1.77	1.73
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.327	0.633	528.0	56.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.44		0.03
Yield {cd/A}	Efficacy {lm/W}		
4.66	526		



Data File Pathname

Z:\data\rdio data\lum4nc\LC020614-1-E LUM4NC 6930323.DAT

Write Data File? Serial Port {0} K2400 GPIB Address Compliance Level

No Yes

0

24

25

Exhibit B

# Standard Cell 4-Quad

>> Enter Panel ID >>  
18 Characters Max

LC020614-1-D

Cell Size (cm^2)  
100.0E-3

Test Date 6/14/02  
Test Start Time 4:09 PM  
Run Time (sec) 121

## Quadrant "1"

Curr Density {mA/cm^2}	20.0	x {CIE}	0.314	Luminance {cd/m^2}	1289	Radiance {W/Sr/m^2}	2.41	Efficiency {lm/W}	2.48	Bandwidth {nm}	32.0
Current {mA}	2.000	Voltage {VDC}	8.17	Efficacy {lm/W}	534	Peak WL {nm}	528.0	Efficiency {W/A}	0.04		
Yield {cd/A}	6.45										

## Quadrant "2"

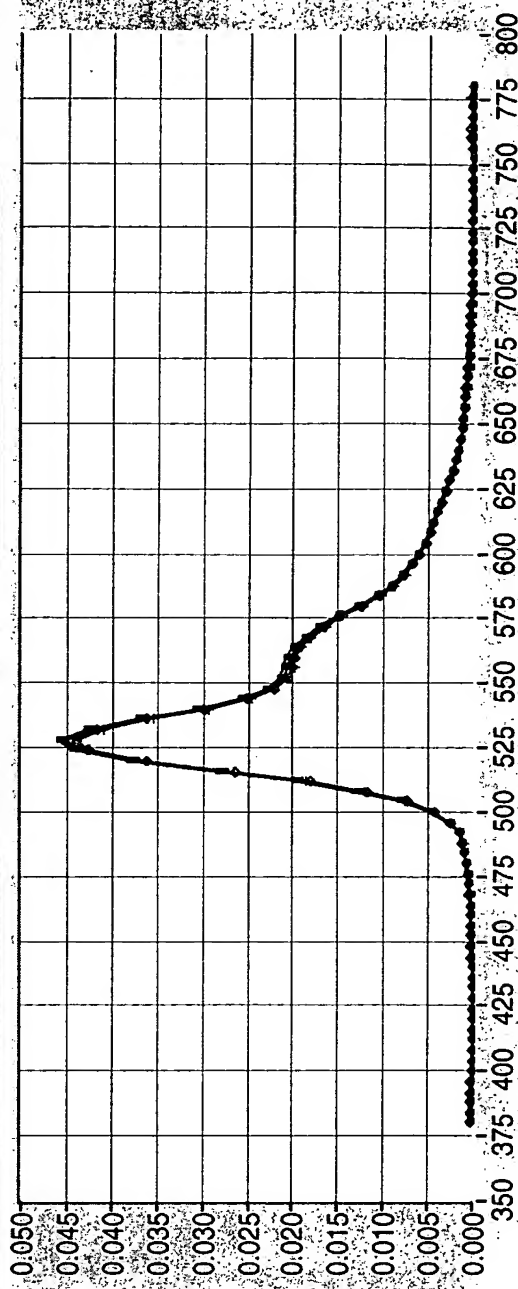
Curr Density {mA/cm^2}	20.0	x {CIE}	0.314	Luminance {cd/m^2}	1311	Radiance {W/Sr/m^2}	2.45	Efficiency {lm/W}	2.48	Bandwidth {nm}	36.0
Current {mA}	2.000	Voltage {VDC}	8.31	Efficacy {lm/W}	535	Peak WL {nm}	528.0	Efficiency {W/A}	0.04		
Yield {cd/A}	6.56										

## Quadrant "3"

Curr Density {mA/cm^2}	20.0	x {CIE}	0.315	Luminance {cd/m^2}	1248	Radiance {W/Sr/m^2}	2.33	Efficiency {lm/W}	2.33	Bandwidth {nm}	36.0
Current {mA}	2.000	Voltage {VDC}	8.40	Efficacy {lm/W}	534	Peak WL {nm}	528.0	Efficiency {W/A}	0.04		
Yield {cd/A}	6.24										

## Quadrant "4"

Curr Density {mA/cm^2}	20.0	x {CIE}	0.315	Luminance {cd/m^2}	1260	Radiance {W/Sr/m^2}	2.36	Efficiency {lm/W}	2.35	Bandwidth {nm}	32.0
Current {mA}	2.000	Voltage {VDC}	8.41	Efficacy {lm/W}	534	Peak WL {nm}	528.0	Efficiency {W/A}	0.04		
Yield {cd/A}	6.30										



Data File Pathname

Z:\data\rdio data\lum4nc\LC020614-1-D LUM4NC 6930144.DAT

Write Data File? Serial Port {0} K2400 GPIB Address Compliance Level

No ☒ Yes ☐

24

25



# Standard Cell 4-Quad

>> Enter Panel ID >>  
 18 Characters Max

LC020614-1-C

Cell Size (cm^2)  
 100.0E-3

Test Date 6/14/02  
 Test Start Time 4:06 PM  
 Run Time (sec) 122

## Quadrant "1"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1524	2.85	3.23
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.309	0.649	528.0	32.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.42		0.04
Yield {cd/A}	Efficacy {lm/W}		
7.62	535		

## Quadrant "2"

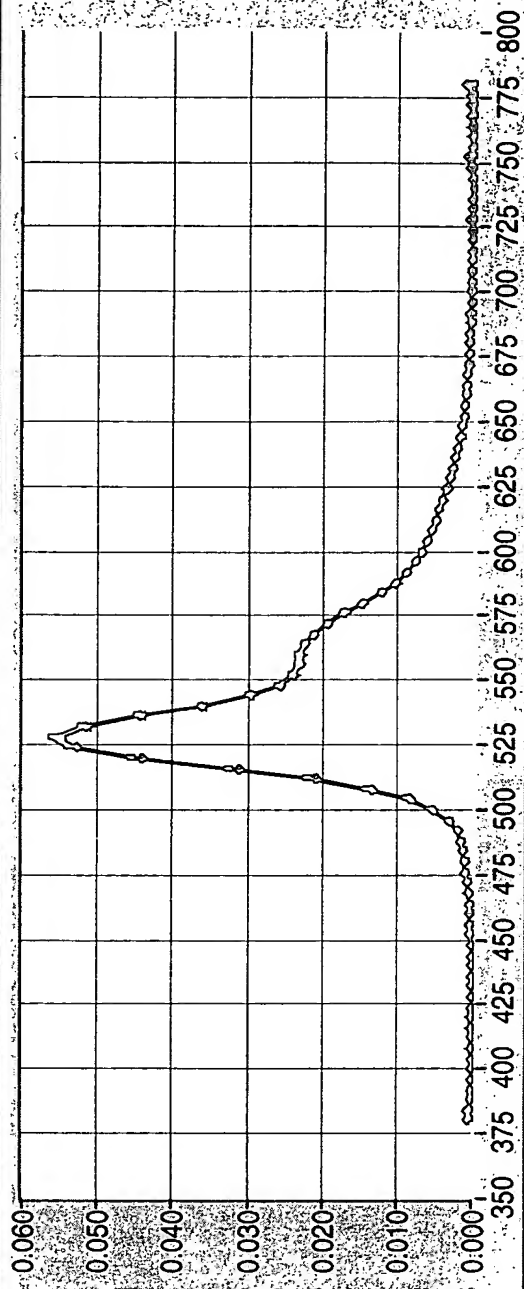
Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1522	2.84	3.19
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.308	0.649	528.0	32.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.50		0.04
Yield {cd/A}	Efficacy {lm/W}		
7.61	535		

## Quadrant "3"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1485	2.77	3.12
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.310	0.647	528.0	32.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.47		0.04
Yield {cd/A}	Efficacy {lm/W}		
7.43	535		

## Quadrant "4"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1492	2.80	3.13
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.310	0.647	528.0	32.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.48		0.04
Yield {cd/A}	Efficacy {lm/W}		
7.46	532		



Data File Pathname

z:\data\rdio data\lum4nc\LC020614-1-C LUM4NC 6929993.DAT

Write Data File? Serial Port {0} K2400 GPIB Address Compliance Level

No Yes

24

25

Std Cell 4Quad  
Z:\Utilities\LabVIEW Tests\RDIO\Std Cell 4Quad.vi  
Last modified on 3/12/02 at 9:31 AM  
Printed on 3/12/02 at 4:06 PM

# Standard Cell 4-Quad

>> Enter Panel ID >>  
18 Characters Max

LC020614-1-B

Test Date 6/14/02  
Test Start Time 4:03 PM  
Run Time (sec) 150

Cell Size (cm^2)  
100.0E-3

## Quadrant "1"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1727	3.20	3.40
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.310	0.649	528.0	24.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.97		0.05
Yield {cd/A}	Efficacy {lm/W}		
8.64	539		

## Quadrant "2"

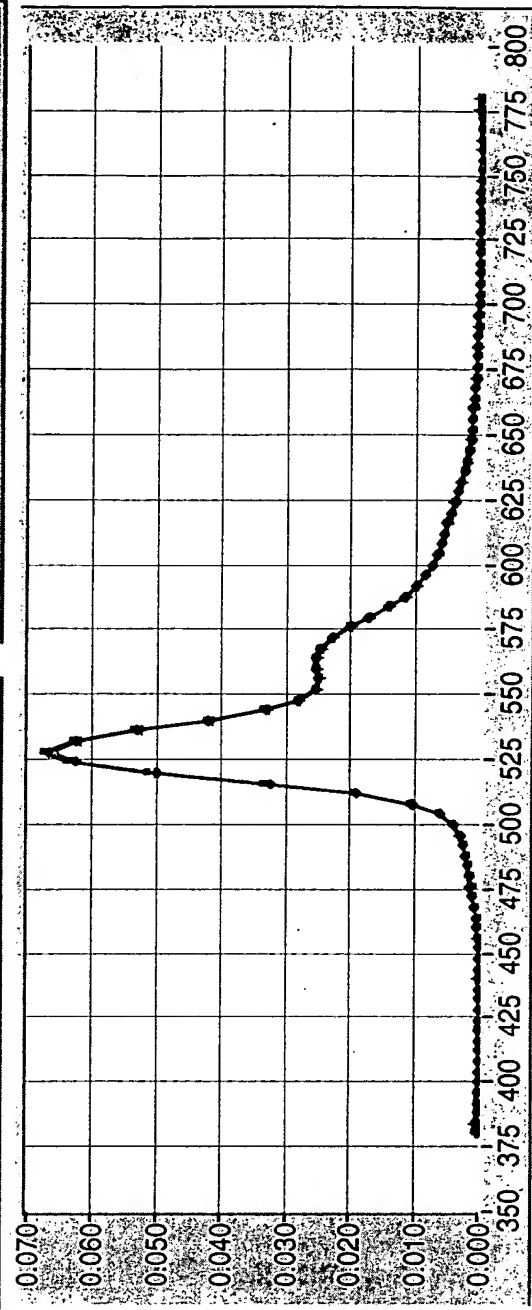
Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1708	3.17	3.33
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.309	0.649	528.0	24.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.05		0.05
Yield {cd/A}	Efficacy {lm/W}		
8.54	538		

## Quadrant "3"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1663	3.12	3.30
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.311	0.648	528.0	24.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	8.02		0.05
Yield {cd/A}	Efficacy {lm/W}		
8.42	539		

## Quadrant "4"

Curr Density {mA/cm^2}	Luminance {cd/m^2}	Radiance {W/Sr/m^2}	Efficiency {lm/W}
20.0	1697	3.13	3.37
x {CIE}	y {CIE}	Peak WL {nm}	Bandwidth {nm}
0.311	0.649	528.0	24.0
Current {mA}	Voltage {VDC}		Efficiency {W/A}
2.000	7.91		0.05
Yield {cd/A}	Efficacy {lm/W}		
8.49	542		



Data File Pathname

z:\data\rdio data\lum4nc\LC020614-1-B LUM4NC 6929820.DAT

Write Data File? Serial Port {0} K2400 GPIB Address Compliance Level

No ☐ Yes ☒ 0

24

25



Exhibit C

Operational Fade @ 20 mA/cm<sup>2</sup>

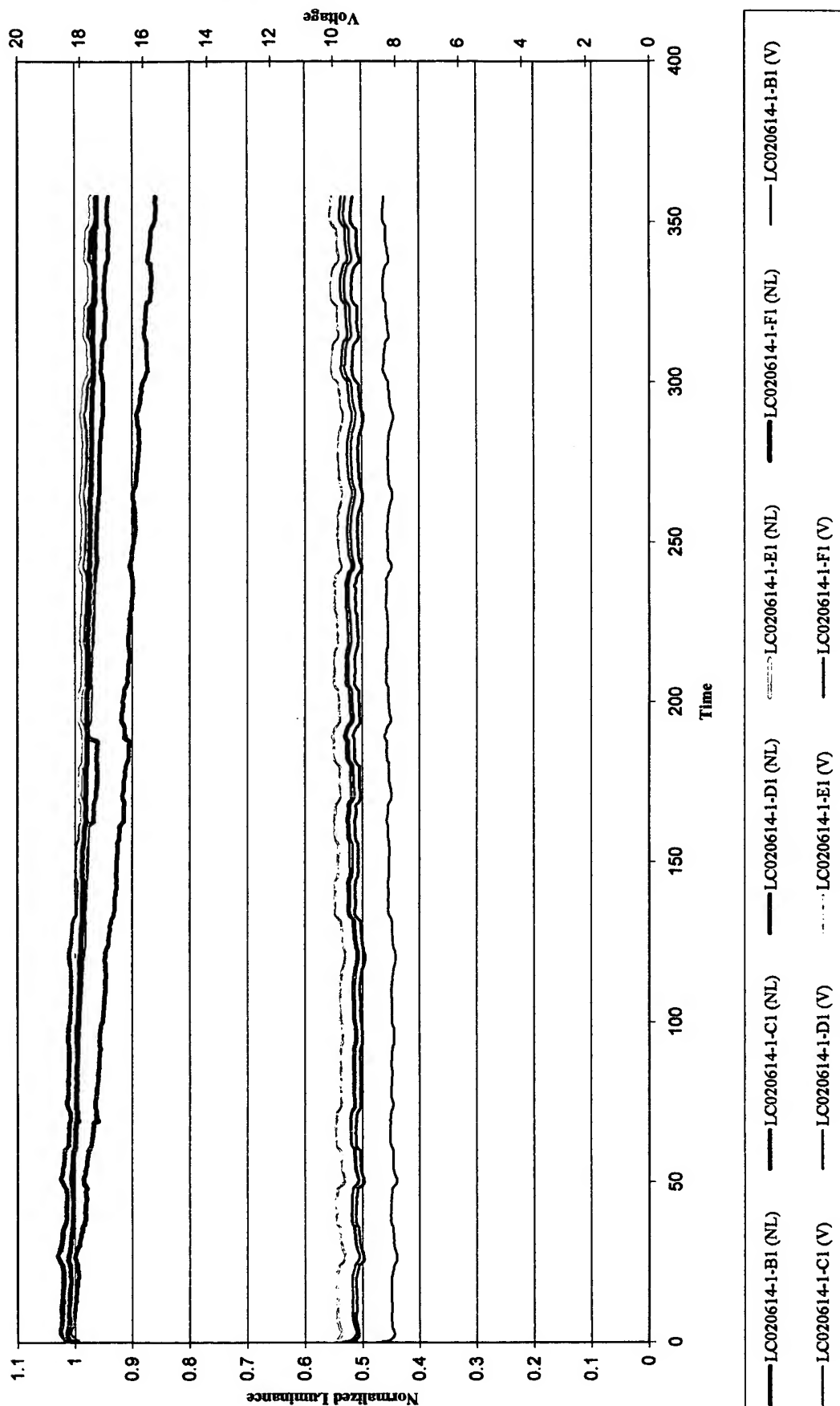


Exhibit C

BEST AVAILABLE COPY

Normalized Luminance vs. Time

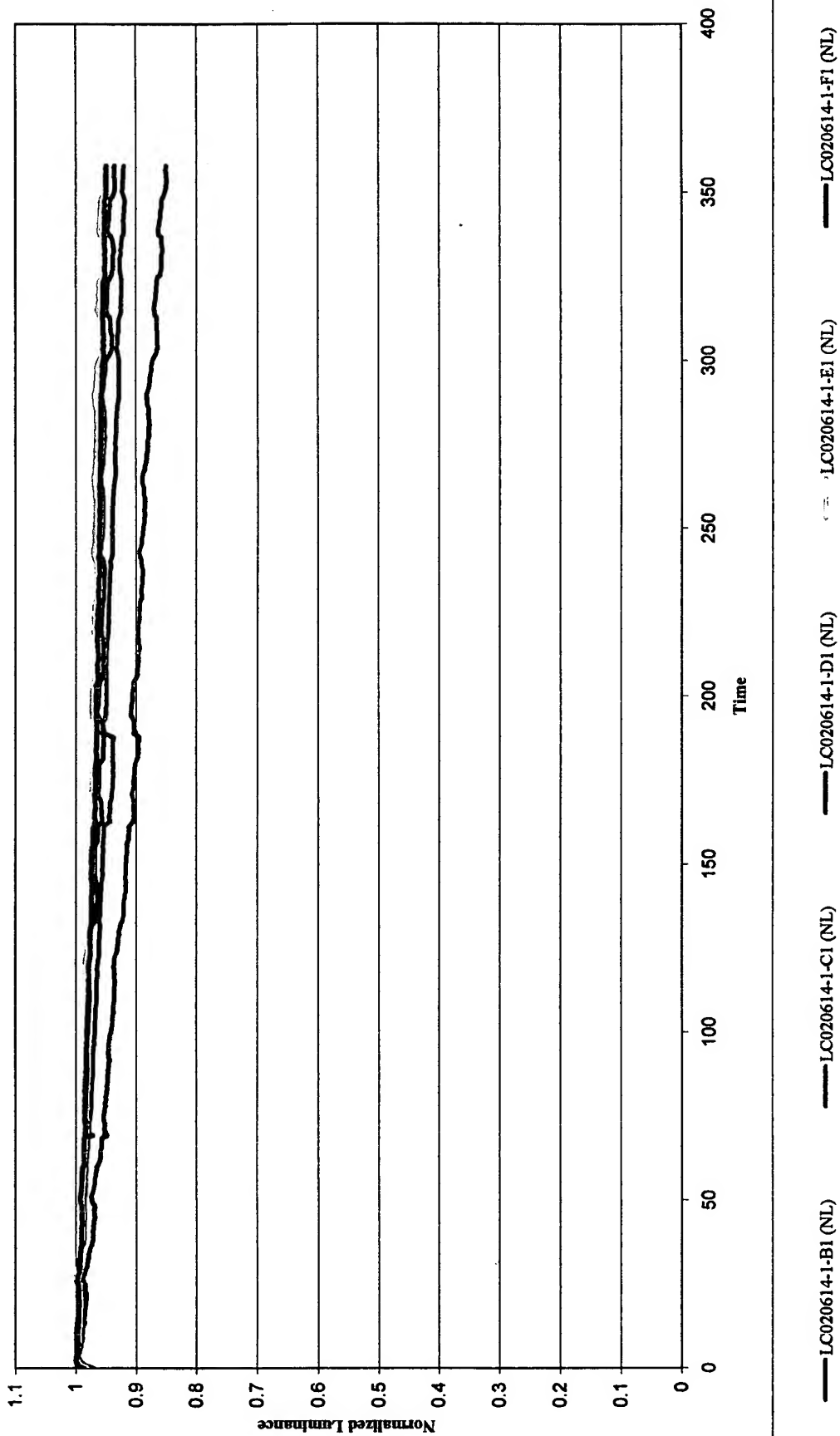


Exhibit D

Cell ID: LC020614-1-B1 Initial Lumi 1727  
 Start Date: Item 3  
 Comments:

d time	V OLED	V Sensor	Lum.	Abs. Lum.	Norm. Lum.
0	9.711	1.743	1	1727	0.989217
0.4	9.494	1.738	0.997131	1722.046	0.986379
0.4	9.492	1.737	0.996558	1721.055	0.985812
0.4	9.488	1.737	0.996558	1721.055	0.985812
0.5	9.485	1.735	0.99541	1719.073	0.984677
0.5	9.47	1.742	0.999426	1726.009	0.988649
0.5	9.468	1.739	0.997705	1723.037	0.986947
0.6	9.466	1.742	0.999426	1726.009	0.988649
0.6	9.46	1.741	0.998853	1725.018	0.988082
0.7	9.435	1.745	1.001147	1728.982	0.990352
0.9	9.409	1.749	1.003442	1732.945	0.992622
1.1	9.383	1.749	1.003442	1732.945	0.992622
1.2	9.37	1.753	1.005737	1736.908	0.994892
1.4	9.355	1.753	1.005737	1736.908	0.994892
1.6	9.335	1.753	1.005737	1736.908	0.994892
1.7	9.331	1.757	1.008032	1740.871	0.997162
1.9	9.321	1.757	1.008032	1740.871	0.997162
2.1	9.305	1.756	1.007458	1739.881	0.996595
2.2	9.302	1.758	1.008606	1741.862	0.99773
2.4	9.294	1.758	1.008606	1741.862	0.99773
2.6	9.28	1.759	1.00918	1742.853	0.998297
2.7	9.283	1.76	1.009753	1743.844	0.998865
2.9	9.281	1.76	1.009753	1743.844	0.998865
3.1	9.275	1.761	1.010327	1744.835	0.999432
3.2	9.282	1.762	1.010901	1745.826	1
3.4	9.285	1.761	1.010327	1744.835	0.999432
3.6	9.283	1.759	1.00918	1742.853	0.998297
3.7	9.297	1.76	1.009753	1743.844	0.998865
3.9	9.303	1.759	1.00918	1742.853	0.998297
4.1	9.305	1.757	1.008032	1740.871	0.997162
4.2	9.319	1.757	1.008032	1740.871	0.997162
4.4	9.326	1.757	1.008032	1740.871	0.997162
4.6	9.324	1.754	1.006311	1737.899	0.99546
4.7	9.341	1.755	1.006885	1738.89	0.996027
4.9	9.347	1.754	1.006311	1737.899	0.99546
5.1	9.347	1.753	1.005737	1736.908	0.994892
5.6	9.362	1.751	1.00459	1734.927	0.993757
6.1	9.38	1.75	1.004016	1733.936	0.99319
6.6	9.39	1.747	1.002295	1730.963	0.991487
7.1	9.404	1.746	1.001721	1729.972	0.990919
7.6	9.405	1.746	1.001721	1729.972	0.990919
8.1	9.41	1.745	1.001147	1728.982	0.990352
8.6	9.407	1.744	1.000574	1727.991	0.989784
9.1	9.409	1.744	1.000574	1727.991	0.989784

Exhibit D

Cell ID: LC020614-1-C1 Initial Lumi 1524

Start Date: Item 3

Comments:

d time	VOLED	V Sensor	Lum.	Abs. Lum.	Norm. Lum.
0	8.54	1.586	1	1524	0.976601
0.4	8.287	1.603	1.010719	1540.335	0.987069
0.4	8.285	1.603	1.010719	1540.335	0.987069
0.4	8.279	1.604	1.011349	1541.296	0.987685
0.5	8.277	1.603	1.010719	1540.335	0.987069
0.5	8.26	1.606	1.01261	1543.218	0.988916
0.5	8.258	1.605	1.01198	1542.257	0.9883
0.6	8.254	1.606	1.01261	1543.218	0.988916
0.6	8.248	1.606	1.01261	1543.218	0.988916
0.7	8.223	1.61	1.015132	1547.062	0.991379
0.9	8.198	1.612	1.016393	1548.984	0.992611
1.1	8.175	1.612	1.016393	1548.984	0.992611
1.2	8.157	1.615	1.018285	1551.866	0.994458
1.4	8.141	1.616	1.018916	1552.827	0.995074
1.6	8.122	1.616	1.018916	1552.827	0.995074
1.7	8.115	1.618	1.020177	1554.749	0.996305
1.9	8.106	1.619	1.020807	1555.71	0.996921
2.1	8.094	1.619	1.020807	1555.71	0.996921
2.2	8.088	1.62	1.021438	1556.671	0.997537
2.4	8.083	1.621	1.022068	1557.632	0.998153
2.6	8.076	1.62	1.021438	1556.671	0.997537
2.7	8.083	1.62	1.021438	1556.671	0.997537
2.9	8.083	1.62	1.021438	1556.671	0.997537
3.1	8.084	1.619	1.020807	1555.71	0.996921
3.2	8.094	1.62	1.021438	1556.671	0.997537
3.4	8.098	1.62	1.021438	1556.671	0.997537
3.6	8.098	1.619	1.020807	1555.71	0.996921
3.7	8.115	1.62	1.021438	1556.671	0.997537
3.9	8.125	1.62	1.021438	1556.671	0.997537
4.1	8.132	1.62	1.021438	1556.671	0.997537
4.2	8.143	1.62	1.021438	1556.671	0.997537
4.4	8.148	1.62	1.021438	1556.671	0.997537
4.6	8.142	1.62	1.021438	1556.671	0.997537
4.7	8.149	1.622	1.022699	1558.593	0.998768
4.9	8.147	1.622	1.022699	1558.593	0.998768
5.1	8.142	1.622	1.022699	1558.593	0.998768
5.6	8.143	1.623	1.023329	1559.554	0.999384
6.1	8.151	1.623	1.023329	1559.554	0.999384
6.6	8.16	1.623	1.023329	1559.554	0.999384
7.1	8.17	1.622	1.022699	1558.593	0.998768
7.6	8.17	1.623	1.023329	1559.554	0.999384
8.1	8.173	1.623	1.023329	1559.554	0.999384
8.6	8.169	1.622	1.022699	1558.593	0.998768
9.1	8.159	1.623	1.023329	1559.554	0.999384

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